

# Reaching cost-efficient climate neutrality: the essential reboot of the European PV Industry

Climate neutrality by 2050. That is the stated goal. But how does Europe achieve it?

The European Photovoltaic (PV) sector has faced an era of rapid and complex change over the past two decades. If we flashback to the early 2000s, some argued that European PV manufacturing growth would be continuous and dominant.

That did not happen.

European PV-manufacturing did lead the industry in the 2000s, underpinned by subsidized regional demand driven by the

2004 German Energiewende law. From late in the decade and onwards, China's PV-industry accelerated, again on the back of regulations that stimulated significant local demand, coupled with regulation-mandated access to growth capital and a considerable knack for large-scale industrial establishments and large-scale industrial operations.

The European PV-industry was unable to stay competitive and exploit new markets

and, thus, it waned. One might say the European PV-industry's near-demise was due to an inability to meet the challenge of the rapid price reductions that drove annual global PV-installations to quadruple from 2011 to 2020.

Currently, Europe, the USA and India find themselves without significant domestic PV-manufacturing. At the same time, annual PV-installations are in the multi-gigawatt

scale (Europe and the USA each have domestic annual installation volumes equal to or larger than the entire world market in 2010). Concern has arisen, regarding the complete dependency of importation and the global concentration of production capacity.

Throughout it all there have been stalwarts that are holding out despite sub-scale production capacities. There are also new entrants with exciting new technologies.

Since 2018, a robust conversation has been growing to effectively reboot and recreate a strong European PV ecosystem from polysilicon, ingots, wafers, cells, modules, PV- production equipment, consumables

through building integrated solar, large scale solar projects and applied solar solutions like off-grid cooling. To succeed, industry leaders will need to be more future orientated, collaborative, creative and become deeper thinkers.

It should be noted that the European PV industry will be a complement to (not a replacement for) existing capacity in other regions. At the same time, we need to embrace the paradigm of world class speed and scale if we are to re-establish credible European manufacturing.

The solar PV market has grown substantially, and annual PV additions will keep growing by

~17% (or more) every year until 2024. The IEA itself foresees 391 GW of PV installed in Europe in its World Energy Outlook 2020's Sustainable Development Scenario. But the market could request even higher figures. If the market continues such a growth trend, solar PV could easily overtake the 400 GW mark well before 2030.

To harness these changes the 'European Solar Reboot' is based on several success factors which are clearly interdependent.

**Localising Manufacture to facilitate Secure Access to Solar PV value chain**

Solar Power Europe's 'Global Market Outlook for Solar Power 2021-2025 Report'

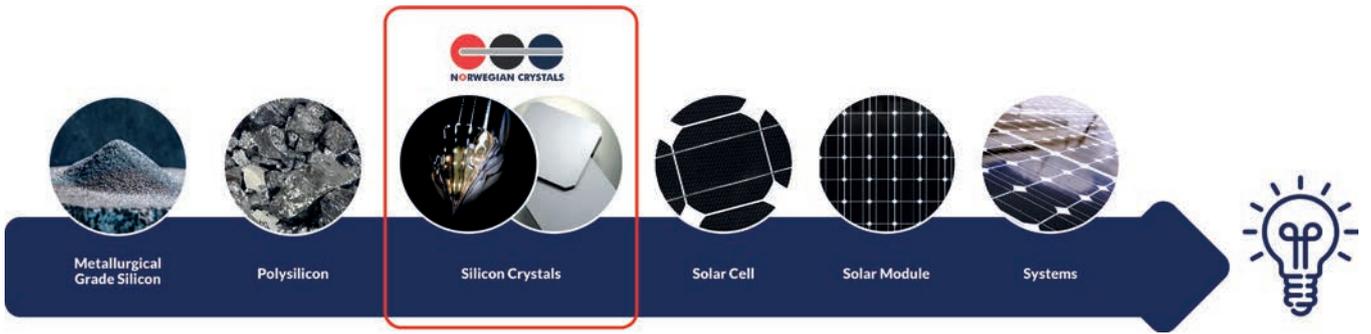


Figure 1. Current world view of the linear solar PV value chain

highlighted again how solar is now playing a critical part of the global energy mix with every third power plant installation coming from solar. There is momentum to redevelop PV manufacturing in Europe, due in part to the important growth of the domestic market in the short to medium term. Localising PV manufacture in Europe secures access to supply across the Solar PV value chain.

**Leading through technology know-how.**

Transporting solar modules to Europe halfway around the globe accounts for about 10% of their cost. By utilising leading European manufacturing in local markets, we can establish a lower carbon footprint at a lower financial cost.

We are already seeing this become a reality as newer high-tech European production facilities are preparing to scale up across France, Spain, Germany, and Norway.

As the Europe Solar Value Chain builds its economies of scale, alongside Europe's R&D excellence, the anticipated improvements will influence the efficiency at each lifecycle stage contributing significantly to stronger solar performance and competitiveness. However, to achieve this vision, all segments of the PV value chain need to participate in the European Solar Industry Reboot.

**The Circular Economy and the strategic advantage of WEEE**

A circular economy aims to 'design out' waste altogether. Products are designed and optimised for a cycle of disassembly and reuse. The European regulations in place requiring solar panel producers to collect and recycle the panels they sell, provide the Solar Value Chain a unique strategic advantage.

The Waste Electrical and Electronic Equipment (WEEE) Directive has stimulated the development and growth of solar recycling plants. With 96% of the materials from a panel being extracted, right within the EU, provides the unique opportunity to re-use these local materials across the Solar PV value chain as feedstock.

McKinsey has suggested the circular economy in Europe could generate a net economic benefit of €1.8 trillion by 2030.

Source: [mckinsey.com/business-functions/sustainability](https://mckinsey.com/business-functions/sustainability)

Often the current view of the Solar PV value chain is linear (see Figure 1). The transition from a linear to a circular economy will require a strategic joint effort by stakeholders across the European solar value chain.

Perhaps a starting point in our EU Solar PV Reboot is to contribute European R&D know-how to this transition by developing competencies in circular design.

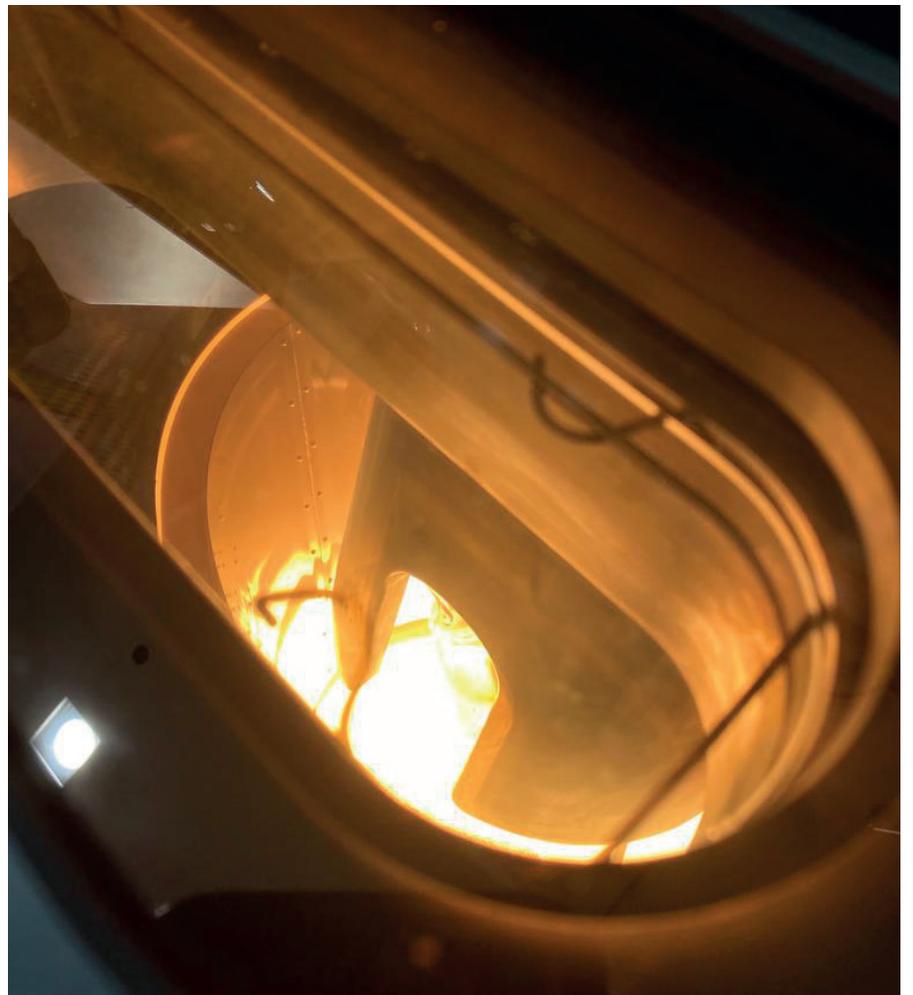
Circular design in the European Solar PV industry places it in a unique cost position

where the utilization of the entire value chain can be cost competitive with other manufacturing locations because of process and production efficiencies (e.g. lower shipping / supply chain costs), improved automation and access to sourcing feedstock from areas with no social transgressions.

**The key gap in the Solar Value Chain: the need to develop the entire ecosystem**

The speed and scale in the PV-industry is breathtaking and has been so for over 15 years. Most of that growth has been centred in China.

If the European Solar Reboot looks to



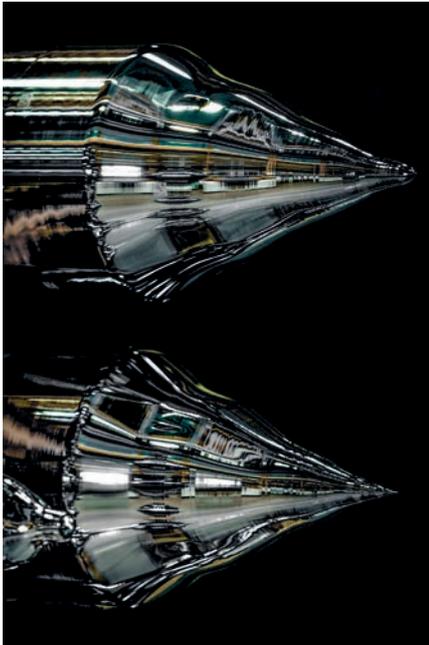
self-sufficiency through innovation and identifying the true ESG impact of PV manufacturing, both the upstream and downstream processes will need scrutinizing.

A key component of solar panels is the monocrystalline silicon wafer.

Recently noted by SolarPower Europe, the manufacturing gap in the value chain - processing polysilicon to ingots, bricks and wafers (currently 99% of which is produced in China) needs to be addressed.

Norway has one of the lowest power prices in Europe and it produces electricity with the lowest carbon intensity.

With access to hydro energy, naturally cooled water, space to expand and extensive experience in monocrystalline wafer manufacturing, NCR is only a small step away from increasing Europe's ingot capacity. Currently at 0.5 GWp/y production of ultra-low



NCR Manufacture: Designing for Circularity	
Inputs	Outputs
Novel energy control systems	Improve energy efficiency, lower costs
Natural cooling water source	Warm water > fish farm
Responsibly sourced polysilicon	Ingots to brick – waste reuse
Process gasses	Closed loop recycle to reduce waste

Figure 2. Norwegian Crystals in its development of ultra-low carbon mono-silicon ingots (ULCF-Si™) continues to design for circularity

carbon footprint, the intention is to grow.

The goal is, to establish a competitive production capacity in Glomfjord of 10 GWp per year. At this capacity, NCR will enable annual power generation equal to 200 million barrels of oil or 350 TWh – nearly three times Norway's electricity production. Avoided CO<sub>2</sub>-emissions every year would amount to around seven times the Norwegian emissions.

**Lowering the European Carbon Footprint by working together:**

The world is rapidly moving to embrace low carbon footprint manufacturing.

Low-Carbon footprint requirements have increasingly become the norm for importation of goods in countries across the globe. In the solar PV sector France, the Netherlands, and Korea have already established specific low-carbon incentives.

According to the Ultra-Low-Carbon Solar Alliance, the use of materials with lower embodied carbon in PV panels can reduce the carbon footprint of solar systems by 50 percent, regardless of where the panels are produced.

With its trademarked Ultra Low Carbon Footprint Silicon (ULCF-Si™)

monocrystalline bricks, NCR already produces industry-leading, certified low carbon ingots and wafers.

NCR is actively building relationships with European equipment makers and process and materials suppliers to develop technology adaptations suitable for a European PV-manufacturing chain. Norwegian Crystals' vision is to be the leading European producer of monocrystalline silicon for solar power and is committed to being part of the exciting momentum to re boot the European Solar PV industry.

The European Solar Value Chain has come through the last two decades of 'survival.' In this challenging global landscape, this will not be enough. We need to become resilient, and rebound, with an attitude to re-establish our relevance. Europe's R&D know-how and ability to scale up rapidly enable us to co-create.

To grow from disruption and enrich the entire European Solar Value Chain will need investment in both downstream and upstream sectors.

Time to thrive and strive for greatness.

[www.crystals.no](http://www.crystals.no)

